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Description of the larvae

Description of caddis larvae (Trichoptera) from northern Thailand of the genera *Himalopsyche* (Rhyacophilidae), *Arctopsyche* (Arctopsychidae), cf. *Eoneureclipsis* (Psychomyiidae) and *Inthanopsyche* (Odontoceridae).

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Abstract. Larvae of *Himalopsyche acharai*, *Arctopsyche hynreck*, *A. variabilis*, cf. *Eoneureclipsis querquobad*, cf. *E. alekto*, and *Inthanopsyche trimeresuri* from Thailand are described and figured.

Introduction

Caddisflies are one of the well-studied group of insects in Thailand with more than 700 known species (see e.g. MALICKY & CHANTARAMONGKOL 1993, 1999, THAPANYA & al. 2004), but very few larvae are known at species level. Various studies (BONADA & al. 2004, BAILEY & al. 2001, DOHET 2002, LENAT & RESH 2001) have shown that the lowest level of taxonomic identification is necessary for the best use of aquatic insects for ecological studies and as indicators of water quality. Without a sufficient knowledge of identification, ecological, environmental and other studies are hindered. The present paper is a contribution to the better knowledge of larval Trichoptera.

Material and methods

Most larvae were collected in the field in the streams Mae Klang and Mae Pan on Doi Inthanon and in Huai Kaew on Doi Suthep by hand picking and kick sampling in various microhabitats and preserved in 70% ethanol. Some specimens were collected in other streams as indicated below. Identification was mainly made by the comparison of the larval sclerites in the cases of fully developed pupae, which were identified by their adult characters. Voucher specimens have been deposited in the Department of Biology, Faculty of Science, Chiangmai University.

The localities, with abbreviations, of the specimens collected by P. Thamsenanupap:

SY: Sai Yoi waterfall (18°49'N, 98°55'E, altitude 1100m, Doi Suthep)

MTT: Montatan waterfall (18°49'N, 98°55'E, 700m, Doi Suthep)

SRP: Siriphum waterfall (18°33'N, 98°31'E, 1460m, Doi Inthanon)

MK: Mae Klang stream near Ban Sop Aep (18°32'N, 98°37'E, 543m, Doi Inthanon)

HSL: Huai Sai Lüang waterfall (18°32'N, 98°27'E, 1060m, Doi Inthanon)

MP: Mae Pan stream near Ban Mae Pan (18°31'N, 98°25'E, 750m, Doi Inthanon)

L: number of larval specimens

P: number of pupal specimens

mp: male pupa

fp: female pupa

Lp: leaf pack

Mar: margin

Gra: riffle

Cra: crash zone

Mad: madicolous zone

Spl: splash zone

Himalopsyche acharai MALICKY & CHANTARAMONGKOL 1989

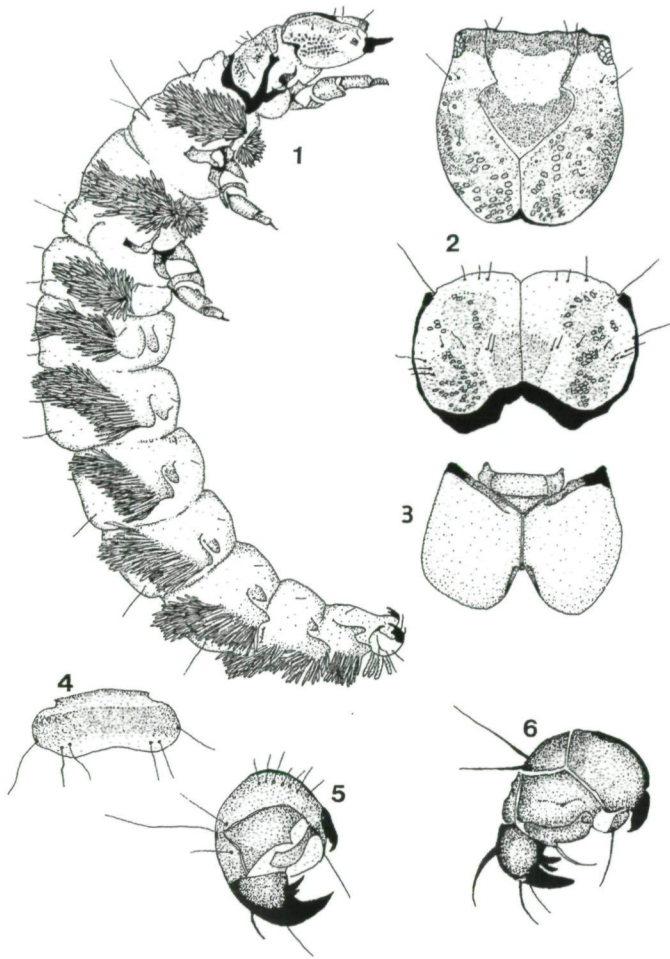
The larva is large and stout. The sclerites of the head, pronotum, legs and prolegs are dark brown or black. The head capsule is relatively flat and has a black stripe along the dorsal ecdysial lines. The pronotum is covered by a large sclerite; the meso- and metathorax have ventral dense tufts of gills on each side. The legs and prolegs are very stout. The trochantin is long and apically pointed. The ventrolateral edge of the abdomen has fleshy protuberances on each segment. The 9th abdominal segment has a dorsal sclerite. The anal claws are large. A black stout seta is present on the outer edge of the claw, the inner edge of the claw has two teeth.

The larvae were found in streams of both Doi Inthanon and Doi Suthep-Pui National Parks and are distributed from 400 to 1300m altitude (MALICKY & CHANTARAMONGKOL 1993, SILALOM 2000). *H. acharai* is the only known species of the genus in Thailand, and has been found only in the north of the country. Adults and larvae were common in all six sites named above. Most larvae were collected from torrential habitats, especially on rock surfaces in waterfalls and other places with high turbulence. Larvae were usually found in rock crevices or sometimes on the cases of hydropsychids or aquatic lepidopterans. Some specimens were collected from riffles and fast flowing areas along the stream channel. *Himalopsyche* larvae are predators, using their raptorial forelegs for grasping prey.

Descriptions and figures of *Himalopsyche* larvae are given by LEPNEVA (1964:277), ULMER (1957:131), DUDGEON (1999:375) and WIGGINS (1996:112), but the most important information is found in SCHMID & BOTOSANEANU (1966). These authors name several distinguishing characters between larvae of the *kuldschensis* and the *navasi* group of the genus. *H. acharai* is, like *H. japonica* MORTON 1900, a member of the *navasi* group and has in common with *japonica*: 1. Pronotum with few bristles along the median line, but no clear longitudinal row of bristles; 2. outer side of femur, tibia and tarsus without a row of hairs; 3. no comb-like hair on the coxa; 4. the lateral gill-bearing branches of the abdominal segments are short, and have a ventral short and roundish finger; 5. abdominal segments without ventral sclerites; 6. the outer bristle of the pygopodial claw is stout and curved; 7. from the dorsal base of legs 2 and 3 arises a finger-like membranous filament (which may, however, be detached in many specimens); 8. a pair of large bunch of gill filaments is present ventrally near the anterior edge of thoracic segments 2 and 3. – *H. phryganea* ROSS 1941, also a member of the *navasi* group, shares the characters 1, 2 and 3, but has a small oval sclerite ventrally on each abdominal segment, and the bunches of gill filaments are situated on the wall of the segment itself, without lateral branches, and the ventral bunches of thoracic segment 2 and 3 are lacking. – The only possible difference between the larvae of *H. japonica* and *H. acharai* is in the claw of the thoracic legs: in *japonica* (only one specimen compared) it has a long, straight ventrobasal spine, which is much smaller or lacking in *H. acharai*. But it is also possible that it is worn in our specimens. Our larvae of both species have a length of up to 28 mm.

A throughout generic separation of larvae of *Himalopsyche* and *Rhyacophila* is not possible at present because only a minority of species of both are known.

Specimens of *H. acharai* examined: 1mp: HSL, Gra, 13.1.2003; 2fp: HSL, Gra, 14.11.2002; 1L: SY Cra, 5.5.2002; 1L: SY, Cra, 10.12.2002; 1L: SY, Cra, 5.4.2003; 1L: MTT, Mad, 11.1.2003; 1L: MTT, Cra, 23.4.2003;



Himalopsyche acharai: 1 lateral, 2 head and prothorax dorsal, 3 head ventral, 4 dorsal sclerite of abdominal segment 9, 5 & 6 pygopodium.

1L: MTT, Gra, 14.2.2003; 1L: MTT, Cra, 12.3.2003; 1L: SRP, Cra, 9.5.2002; 1L: SRP, Gra, 10.8.2002; 1L: SRP, Mar, 21.9.2002; 1L: SRP, Cra, 14.11.2002; 1L: MK, Mad, 13.11.2002; 1L: MK, LP, 13.11.2002; 1L: HSL, Mad, 13.1.2003; 1L: HSL, Cra, 14.11.2002; 1L: HSL, Gra, 16.2.2003; 1L: HSL, Cra, 13.1.2003; 1L: HSL, Gra, 14.11.2002; 4L: HSL, Cra, 3.4.2003; 1L: MP, Gra, 14.1.2003.

Specimen of *H. japonica* examined: Japan, Honshu, Ishigawa pref., Mt. Hakusan, 31.8.-2.9.1980, leg. P.Zwick.

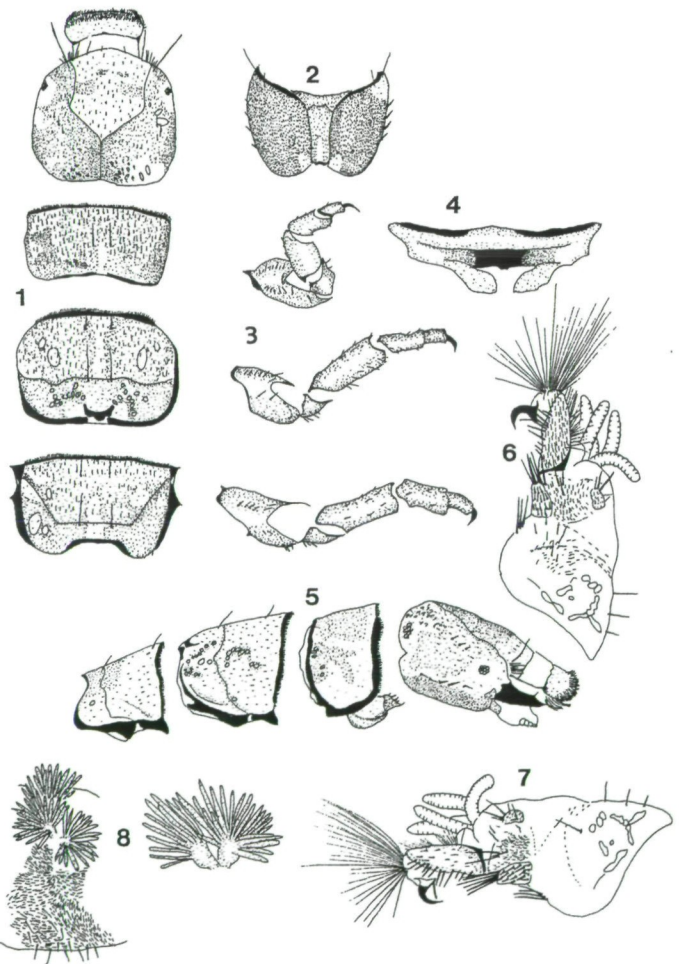
***Arctopsyche hynreck* MALICKY & CHANTARAMONGKOL 1991 and *A. variabilis* SCHMID 1968**

Arctopsyche larvae usually construct a cornucopia-shaped retreat with the large opening facing the water current. In the wall of the retreat and in the lateral ledges of the adjacent net plant debris are included in addition to sand grains. The net is fastened to the ground by many silken filaments. The head of the larva is bulky and yellowish brown to light brown, with a spotted pattern. The ventral apotome (= submentum, gular sclerite) is long and separates completely the genae. Thoracic sclerites are yellowish brown to light brown, with a dark brown median. The pronotum is subdivided by the median ecdysial line. Meso- and metanotal plates are subdivided by transverse ecdysial lines. The forelegs are stouter than the other two pairs of legs. The fore trochantin is sharply pointed and not forked. Abdominal gills are present on the segments 1-7. Gill filaments arise at the

apex of central stalk. Anal prolegs are well developed with a bent claw and bear each a cluster of long bristles.

Arctopsyche larvae are difficult to separate to species. The patterns of head and thorax may be helpful: *A. ladogensis* KOLENATI 1859 and *A. grandis* BANKS 1900 have a characteristic longitudinal clear stripe (LEPNEVA 1964:466, WIGGINS 1996:130). In species from North America, there are slight differences in the arrangement of gill bunches (GIVENS & SMITH 1980). The two species known from Thailand have a more or less typical head pattern which is however variable, and less helpful for the identification. According to the material at our disposition, the following characters are probably better to separate the two species: 1. the anterior edge of the frontoclypeus is evenly slightly rounded in *hynreck*, but in *variabilis* it is slightly stronger bent in the middle. 2. the ventral apotome (= submentum, gular sclerite) is distinctly broader in *variabilis* than in *hynreck*. Full grown larvae of both species have a length of 30 mm.

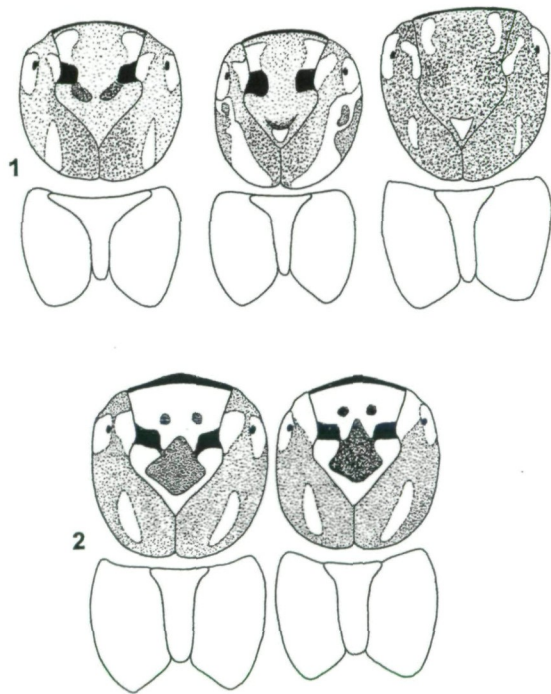
Both species of *Arctopsyche* were found in Thailand only on Doi Inthanon, *A. hynreck* between 400 and 1700m, *A. variabilis* in the higher altitudes between 2000 and 2300m. Most specimens were collected from torrential habitats, especially on the rock surfaces of waterfalls and other sites of high turbulence. Larval cases were found tightly attached to the substrate.



Arctopsyche hynreck: 1 head and thorax dorsal, 2 head ventral, 3 legs lateral, 4 posterior ventral sclerite of prothorax, 5 head and thorax lateral, 6, 7 pygopodium, 8 gills.

Specimens of *A. hynreck* examined: 2L: SRP, Cra, 9.5.2002; 2L: SRP, Lp, 8.6.2002; 1L: SRP, Mar, 21.9.2002; 1L: SRP, Gra, 5.10.2002; 2L: SRP, Gra, 14.11.2002; 2L: SRP, 14.11.2002; 3L: SRP, Mar, 14.11.2002; 1L: SRP, Cra, 13.1.2002; 2L: SRP, Mad, 13.1.2003; 3L: SRP, Gra, 13.1.2002; 1L: SRP, Gra, 16.2.2003; 1L: SRP, Lp, 16.2.2003; 1L: SRP, Mar, 14.3.2003; 8L: SRP, Gra, 3.4.2003; 2L: SRP, Gra & Mar, 3.4.2003; 1L: HSL, Mad, 6.7.2002; 4L: HSL, Cra, 6.10.2002; 3L: HSL, Cra, 22.11.2002; 1L: HSL, Lp, 22.11.2002; 1L: HSL, Mad, 13.1.2003; 1L: HSL, Lp, 13.1.2003; 8L: HSL, Cra, 16.2.2003; 10L: HSL, Gra, 16.2.2003; 18L: HSL, Cra, 14.3.2003; 2L: HSL, Gra, 14.3.2003; 5L: HSL, Lp, 14.3.2003; 16L: HSL, Cra, 3.4.2003; 3L: HSL, Lp, 16.2.2003; 4L: HSL, Gra, 3.4.2003; 1L: MP, Cra, 7.12.2002; 3L: MP, Lp, 14.1.2003; 2L: MP, Cra, 17.2.2003; 1L: MP, Lp, 4.3.2003; 1L: MP, Cra, 4.4.2003; 1L: MP, Gra, 4.4.2003. – Mae Klang below Ban Khun Klang at 1200m, 8.4.1989: 5 larvae, leg. Malicky.

Specimens of *A. variabilis* examined: Doi Inthanon, stream at 2300m, 17.12.1989: 3 larvae, and 6.1.1990: 3 larvae, leg. Malicky.



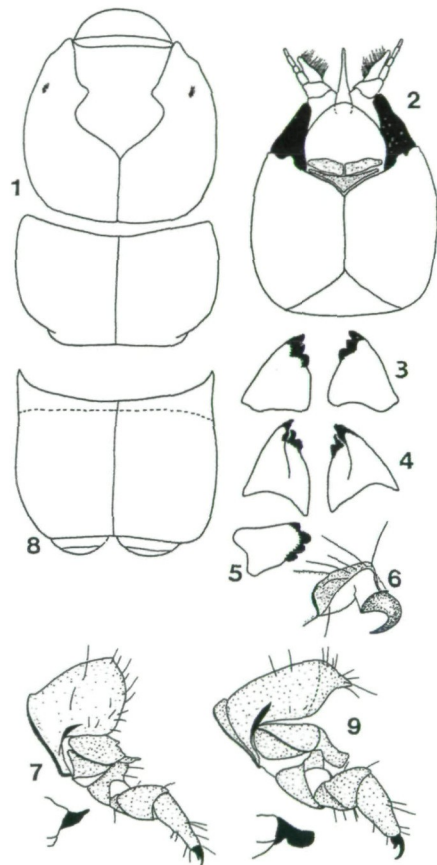
Arctopsyche spp.: head dorsal and ventral, variation of head pattern of *A. hynreck* (1) and *A. variabilis* (2).

Eoneureclipsis spp. (cf.) (Psychomyiidae)

The larvae described below resemble the typical slender larva of Psychomyiidae and have the general shape of *Tinodes* or *Psychomyia* with the characteristic “spinning finger”, but our largest larvae have a length of 28 mm, while average *Tinodes* larvae from Europe may be about 10 mm, and tropical *Tinodes* or *Psychomyia* are even smaller. The only known genus of Psychomyiidae with distinctly larger adults is *Eoneureclipsis*, so it is very probable that our larvae belong here. From our records of adult males, found at the same sites or nearby, the specimens from Doi Inthanon could be *E. querquobad* MALICKY & CHANTARAMONGKOL 1989, and those from Waterwheel Falls could be *E. alekto* MALICKY & CHANTARAMONGKOL 1997. We have no pupae with larval sclerites.

The general shape of the larvae is as in *Lype*, *Paduniella*, *Tinodes* or *Psychomyia* of which figures and descriptions may be found e.g. in WIGGINS (1996:174-183). The claws of the thoracic legs have one ventral tooth; the mandibles have each four large, rounded teeth, and the pygopodial claws have no ventral teeth. The anterior legs are distinctly larger and stronger than the other two pairs. The maxillary lobe is finger-like, slender and has a comb of long and fine hairs along its inner edge. The two species are however different in other characters:

The larva from Doi Inthanon (presumably *E. querquobad*): This larva has a “normal” pronotum, i.e. with fairly rounded anterior edge. The sclerotized parts (head capsule, pronotum, etc.) are light reddish brown, and the prothorax is small and slightly pointed.



cf. *Eoneureclipsis*: 1 head and pronotum dorsal, 2 head ventral, 3, 4, 5 mandibles ventral, dorsal and lateral, 6 pygopodium, 7 pronotum, foreleg and prothorax, lateral of *E. cf. querquobad*, 8 pronotum dorsal, 9 pronotum, foreleg and prothorax, lateral of *E. cf. alekto*.

The larva from Waterwheel Falls (presumably *E. alekto*) has darker sclerites than the former one, which are dark brown. The pronotum has long, triangular protruding lateral corners which are sharply pointed in dorsal view. The posterior edge of the pronotum has a distinctly separated, bilobate ledge. The prothorax is large and approximately rectangular, with concave dorsal and convex ventral edge.

Both larvae were found in rotten wood which they were mining. Their gut contained small pieces of wood, so they are probably wood-feeders like the larvae of *Lype* spp. (SPÄNHOF, ALECKE & MEYER 1999). This is supported by the coarse structure of their mandibles.

Specimens of cf. *E. querquobad* studied: Doi Inthanon, Mae Pan Trail, 2100m, 15.1.1998: 7 larvae, leg. Alecke, Hoffmann & Robert. – Specimens of cf. *E. alekto* studied: Pitsanulok province, Phu Hin Rongkla National Park, Waterwheel Falls, 1280m, 22.5.2002: many larvae, leg. Nattaphorn Changthong.

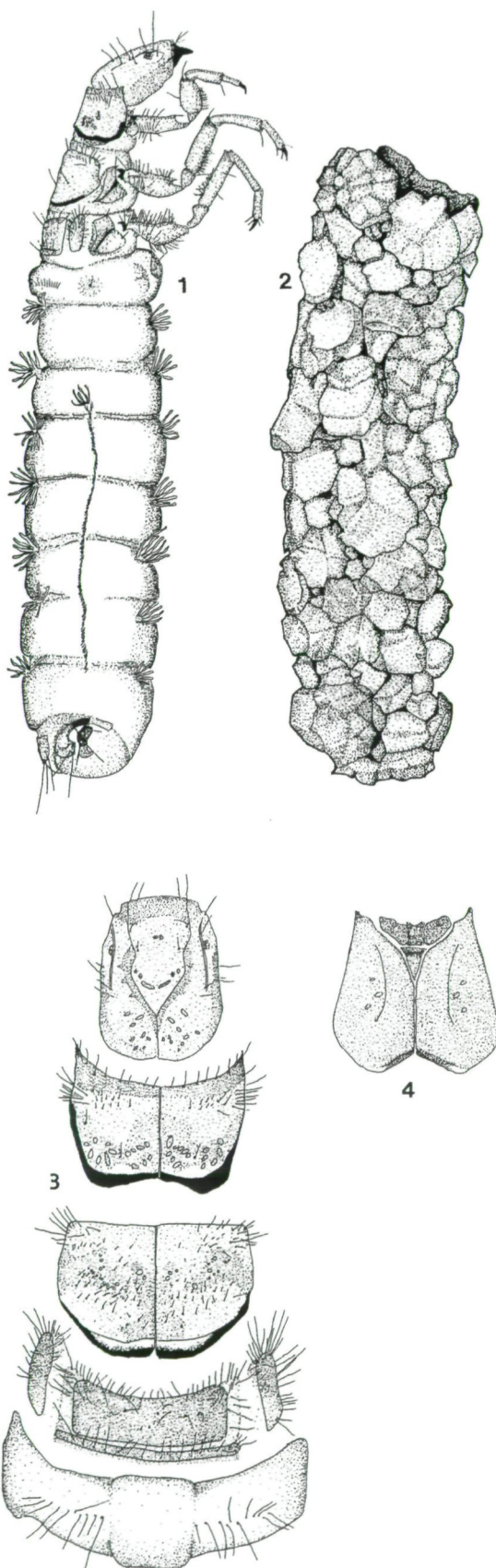
***Inthanopsyche trimeresuri* MALICKY 1989 (Odontoceridae)**

The larva constructs a slightly curved tapered case with coarse sand, like as in *Psilotreta* in shape and material, and it is exceedingly sturdy to resist crushing. This sturdiness appears to be achieved by reinforcing the depressions between connections between pieces with bands of silk. Fine sand grains combined with silk forms the inner wall, which is embraced by the outer wall of coarser particles. The head is longer than broad and yellowish brown. The genae have blackish oval spots dorsally, arranged along the frontoclypeal suture which is darkly shaded. A dark brown shade is ventrally present along the middle of the head capsule. The dorsal and ventral surfaces of the genae longitudinally form a ridge across the eye and parallel to a ventral ecdysial line, respectively. Four black ovoid spots are arranged in a curve in the posterior part of the frontoclypeus, with yellowish brown background. The genae are partly divided by the wedge-like anterior ventral apotome. – Pro- and mesonotum are heavily covered by notal sclerites and divided by median ecdysial lines. The anterior edge of the pronotum is concave with many setae. Each anterolateral corner of the pronotum is sharply pointed. The posterior edges of pro- and mesonotum are black. The metanotum is partly covered by four notal sclerite plates. The fore trochantin is rather round and small with sharply pointed end. On abdominal segment 1, dorsal and lateral humps are present, and a row of 9 to 16 long setae is present across between the median dorsal hump and the lateral hump. Dorsal and ventral filamental gills are present on abdominal segments 2-8, and a pair of lateral gills is present on abdominal segment 3. Lateral fringes are present. Abdominal segment 9 is dorsally covered by a plate of sclerite, with a row of 4-6 long setae along the posterior margin. The fullgrown larva is about 14 mm long.

Various *Psilotreta* larvae may be distinguished by different head patterns. *P. quinlani* KIMMINS 1964 has an almost unicolorous chestnut brown head; *P. rufa* HAGEN 1861 has dark edges to the frontoclypeus (WIGGINS 1996), as has *P. kwantungensis* ULMER 1926 which has a dark longitudinal stripe through the middle of the pro- and mesonotum (DUDGEON 1999), *P. kisoensis* IWATA 1928 has two longitudinal stripes on head and pronotum (LEPNEVA 1966). *I. trimeresuri* has a characteristic head pattern, but this is identical to in *P. watananikorni* MALICKY & CHANTARAMONGKOL 1995. We could not find a clear difference between the larvae of *P. watananikorni* and *I. trimeresuri*, neither between the two genera which are closely related but differ considerably in the wing venation of the adults. The larvae of both genera are however easily distinguished from those of *Marilia*, a common and widespread genus in Thailand, in which the pronotum is rounded anteriorly and has no pointed edges. The larvae of other genera known in Thailand, *Lannapsyche* and *Phraeopsyche*, are unknown.

I. trimeresuri has only been found on Doi Inthanon in low numbers. The larvae live in small, relatively cool streams at slow current in the less turbulent area such as depositional pools in accumulations of sand and rock fragments. Larvae were observed in every month throughout the year, but the adults were collected by blacklight traps from February to April. This was the same period of time as the presence of mature pupae, so *I. trimeresuri* is presumably

univoltine. However ecological and biological studies of this species are still needed.



Inthanopsyche trimeresuri: 1, 2 larva and case lateral, 3 head, thorax and abdominal segment 1 dorsal, 4 head ventral.

Specimens of *I. trimeresuri* examined: 3mp: SRP, Gra, 14.3.2003; 2mp: SRP, Gra, 3.4.2003; 1P: SRP, Gra, 14.3.2003; 1L: SRP, Gra, 14.11.2002; 2L: SRP, Gra, 14.3.2003; 6L: SRP, Gra, 13.1.2003; 1L: SRP, Lp, 16.2.2003; 1L: SRP, Mar, 13.1.2003; 3L: SRP, Gra, 14.11.2002; 2L: SRP, Lp, 13.1.2003. – Specimens of *P. watananikorni* examined: Doi Inthanon, Mae Klang near Ban Sob Aeb, 26.1.1990: many larvae, leg. Malicky. – Specimens of *P. quinlani* examined: Nepal, Kamikarka mountain (27°51'N, 85°40'E) at 2600m, 11.4.1995: 2 larvae, leg. Malicky.

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